## WHAT IS CLAIMED IS:

1	<ol> <li>An anti-stratification-delivery system comprising:</li> </ol>
2	a multi-zone-refrigeration unit having at least first and second zone
3	temperature controllers, the first and second zone temperature controllers are capable of
4	being set at different temperatures to establish a temperature gradient in a liquid, the
5	temperature gradient being sufficient to cause natural thermal convection within the
6	liquid to stir a colloid suspended in the liquid to an approximately uniform colloidal
7	suspension; and
8	a delivery system configured to dispense the approximately uniform
9	colloidal suspension.
1	2. The anti-stratification delivery system of claim 1 wherein the
2	multi-zone-refrigeration unit forms a bottle cavity; and the anti-stratification delivery
3	system further comprises a bottle disposed in the bottle cavity, the bottle configured to
4	contain the liquid and the colloid.
1	3. The anti-stratification delivery system of claim 1 further
2	comprising a thermal insulator disposed around a portion of the multi-zone-
3	refrigeration unit, the thermal insulator configured to insulate the multi-zone-
4	refrigeration unit from an outside atmosphere.
1	4. The anti-stratification delivery system of claim 1 further
2	comprising a thermal insulator disposed between the first and second zone temperature
3	controllers.
1	5. The anti-stratification delivery system of claim 1 wherein the
2	first and second zone temperature controllers are respective first and second zone
3	coolers.
1	6. The anti-stratification delivery system of claim 1 wherein the
2	first zone temperature controller is a zone heater and the second zone temperature
3	controller is a zone cooler.
1	7. The anti-stratification delivery system of claim 1 further
2	comprising:

3	a thermally conductive sleeve disposed in the bottle cavity, the thermally
4	conductive sleeve configured to be removable from the bottle cavity;
5	wherein the bottle is disposed in the thermally conductive sleeve.
1	8. The anti-stratification delivery system of claim 7 wherein the
2	thermally conductive sleeve includes a plurality of thermally conductive portions and a
3	set of thermal insulators disposed between the thermally conductive portions.
1	9. The anti-stratification delivery system of claim 1 wherein the
2	delivery system includes
3	a draw tube configured to dispense the approximately uniform
4	colloidal suspension, the draw tube having a portion disposed into the bottle and
5	a portion extending from the bottle, and
6	a thermal insulator disposed around the portion of the draw tube
7	extending from the bottle.
1	10. The anti-stratification delivery system of claim 1 wherein:
2	the first zone temperature controller includes a first housing having a
3	first set of channels, the first set of channels being configured to carry a first coolant
4	having a first temperature; and
5	the second zone temperature controller includes a second housing
6	having a second set of channels, the second set of channels being configured to carry a
7	second coolant having a second temperature.
1	11. The anti-stratification delivery system of claim 10 wherein the
2	first and second housings are aluminum.
1	12. The anti-stratification delivery system of claim 10 wherein the
2	first and second zone temperatures are independently controllable.
1	13. The anti-stratification delivery system of claim 1 wherein:
2	the first and second zone temperature controllers are disposed
3	horizontally adjacent; and
4	the temperature gradient is established horizontally across the liquid.
1	14. The anti-stratification delivery system of claim 1 wherein:

2	the first and second zone temperature controllers are disposed vertically
3	adjacent; and
4	the temperature gradient is established vertically within the liquid.
1	15. The anti-stratification delivery system of claim 1 wherein the
2	multi-zone refrigeration unit has more than first and second zone temperature
3	controllers configured to establish the temperature gradient.
1	16. The anti-stratification delivery system of claim 1 wherein the
2	colloid and liquid form a low-k spin-on-dielectric precursor.
1	17. A method of dispensing a colloid in liquid, the method
2	comprising:
3	establishing a temperature gradient in the liquid and the colloid;
4	mixing the liquid and the colloid by natural thermal convention to an
5	approximately uniform colloidal suspension; and
6	dispensing through a dispensing system the approximately uniform
7	colloidal suspension.
1	18. The method of claim 17 further comprising setting a maximum
2	temperature of the temperature gradient below an upper colloid-chemical-breakdown
3	temperature.
1	19. The method of claim 17 wherein the liquid and colloid form a
2	low-k spin-on-dielectric precursor.
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2	and dispensing a riquid
	solution for a semiconductor processing tool, the apparatus comprising:
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3 4 5 6 7 8 9	a housing comprising a thermally conductive material, the housing having at least first and second sections that combine to form a cavity, the first and second section being configured to be set at different temperatures;  a thermal insulator comprising a low thermal conductive material, the thermal insulator separating the first and second section of the housing;  a lid attached to the housing that is removable to allow insertion and removal of a bottle from the cavity, the lid comprising an opening to allow for the insertion of a draw tube into a bottle; and

11	an insulating casing that at least partially surrounds the housing.
1	21. The apparatus of claim 1 further comprising a bottle suitable for
2	containing the liquid solution.
1	22. The apparatus of claim 21 wherein the bottle is positioned within
2	the cavity, a first portion of the bottle is in thermal contact with an interior surface of
3	the first section of the housing and a second portion of the bottle is in thermal contact
4	with an interior surface of the second section of the housing.
1	23. The apparatus of claim 21 further comprising a thermal insert
2	forming another cavity, the thermal insert being positioned within the cavity of the
3	housing, a first portion of the thermal insert is in thermal contact with an interior
4	surface of the first section of the housing and a second portion of the thermal insert is in
5	thermal contact with an interior surface of the second section of the housing, wherein
6	the bottle is positioned within the cavity of the thermal insert.
1	24. The apparatus of claim 20 wherein the first section of the
2	housing comprises a first fluid passage that allows a temperature controlled fluid to be
3	circulated throughout the first section and the second section of the housing comprises
4	a second fluid passage that allows a temperature controlled fluid to be circulated
5	throughout the second section, wherein the second fluid passage is fluidically isolated
6	from the first fluid passage.
1	25. The apparatus of claim 20 further comprising a heater coupled to
2	one of the first or second section of the housing and wherein the first and second
3	section of the housing comprise a fluid passage that allows a temperature controlled
4	fluid to be circulated throughout the first and second sections of the housing.
1	26. The apparatus of claim 20 wherein the housing comprises a

- 1 26. The apparatus of claim 20 wherein the housing comprises a cylindrical sidewall and a bottom.
- The apparatus of claims 26 wherein the thermal insulator divides the housing sidewall into upper and lower vertically oriented portions with respect to the cavity, and wherein the first section of the housing comprises a bottom portion and

4	the lower portion of the sidewall and the second section of the housing comprises the
5	upper portion of the sidewall.
1	28. The apparatus of claim 26 wherein the thermal insulator divides
2	the housing sidewall and housing bottom into left and right horizontally oriented
3	portions with respect to the cavity and wherein the first section of the housing
4	comprises the left portion of the sidewall and bottom, and the second section of the
5	housing comprises the right portion of the sidewall and bottom.
1	29. A method for forming an integrated circuit comprising:
2	mixing a spin-on-dielectric (SOD) formulation by natural thermal
3	convection including
4	exposing a first portion of the SOD formulation to a first
5	temperature, and
6	exposing a second portion of the SOD formulation to a second
7	temperature, the difference between the first and second temperatures is
8	sufficient to mix the SOD formulation to an approximately uniform colloidal
9	suspension;
10	dispensing the SOD formulation onto a substrate; and
11	forming a low-k dielectric layer from the SOD formulation.
1	30. The method of claim 29 wherein the forming step includes
2	curing the SOD formulation to form the low-k dielectric layer.
1	31. The method of claim 30 wherein the low-k dielectric layer has a
2	dielectric constant below about 3.0.
1	32. The method of claim 30 wherein the low-k dielectric layer has a
2	dielectric constant below about 2.0.